

FIRST YEAR B.Sc. DEGREE EXAMINATION, APRIL/MAY 2005

Part III—Physics Subsidiary

**PH (MA) 11—CLASSICAL MECHANICS, PROPERTIES OF
MATTER AND THERMAL PHYSICS**

(For Mathematics Main)

(2004 admissions)

Time : Three Hours

Maximum : 50 Marks

Section A

*Answer any two questions.
Each question carries 7 marks.*

1. Derive Hamilton's principle from Lagrange's equation.
2. Write down the differential equation for a damped harmonic oscillator and obtain the general solution of this equation. Discuss the under damped case.
3. Derive Poiseuille's formula.
4. Explain with theory zees disc method of determination of thermal conductivity.

(2 × 7 = 14 marks)

Section B

*Answer any twelve questions.
Each question carries 2 marks.*

5. What are the limitations of Newtonian Mechanics ?
6. What is meant by Holonomic system ?
7. State and prove parallel axes theorem of moment of Inertia.
8. What is a canlilever ? Write down expression for depression at the free end.
9. Write down expression for moment of inertia of a solid sphere about (1) diameter (2) tangent.
10. Define quality factor of an oscillator.
11. Define wave motion and obtain the differential equation of wave motion.
12. What is torsional rigidity. Write down its expression.
13. State the laws of transverse vibrations of stretched strings.
14. Derive the equation for K.E. of a rotating body.
15. Explain how Surface Tension varies with temperature.
16. State Weidman-Franz law.
17. State Rayleigh-Jean's law.

18. Define 'Solar constant'.
19. Write down Kelvin and clausius statements of second law of thermodynamics.
20. What is the change of entropy in reversible and irreversible cycles ?
21. What is meant by Isothermal elasticity ?
22. Draw the p - v -diagram for Petrol Engine.
23. How entropy and disorder are related ?
24. State and explain Planck's law of radiation.

(12 × 2 = 24 marks)

Section C

*Answer any four questions.
Each question carries 3 marks.*

25. A circular disc of radius 0.1 m and mass 1 Kg. is rotating at the rate of 10 revolutions per second about an axis through its centre perpendicular to its plane. Find the work done to increase the rate of revolutions to 20 revolution per second.
26. Derive the expression for period of oscillation of two particles of masses m_1 and m_2 connected by a spring of force constant K .
27. A brass rod of length 3 m is clamped at the centre. It emits a note of frequency 600 Hz, when it vibrates longitudinally. Calculate its Young's modulus (density = 8,300 kg m⁻³)
28. A light metal rod of length 60 cm and of radius r m is clamped at one end, loaded at the free end with 5.5 kg. Calculate the depression of the free end ($Y = 9 \times 10^{10}$ Nm⁻²).
29. An iron plate of area 10^{-5} m² and thickness 4×10^{-3} m has its opposite faces at 373 K and 323 K. How much heat flows through the plate per second. (Thermal conductivity = 80 Wm⁻¹ K⁻¹)
30. Calculate temperature of sun from the following data Stefan's constant = 5.7×10^{-8} Wm⁻² K⁻⁴, Solar constant = 1,500 Wm⁻², Radius of sun = 7×10^8 m, Distance between sun and earth = 1.5×10^{11} m.
31. The efficiency of Carnot's engine is 20 % When temperature of source is increased by 25°C, its efficiency increases to 25 %. Calculate temperature of source and sink.

(4 × 3 = 12 marks)